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Flavor and Slaw Cut Quality Evaluation of Fresh Market Cabbage in 1999

Information on the Effects of Planting Date and Genotype on Fresh Market Cabbage Flavor and Slaw Cut Quality in Ohio in 1999

Matthew D. Kleinhenz and Brenda Schult
Department of Horticulture and Crop Science
The Ohio State University
Ohio Agricultural Research and Development Center (OARDC)
Wooster, Ohio

and

Winston Bash and Gary Wenneker
Food Industries Center and Food Industries Center Pilot Plant
The Ohio State University
Columbus, Ohio

THE OHIO STATE UNIVERSITY
OARDC

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Seed for the genotypes tested in these studies was provided by:

Abbott and Cobb	**Harris Moran**
American Takii	**Petoseed**
Asgrow	**Reed's**
Bejo	**Rispen's**
d. Palmer	**Sakata**

Project Summary

Twenty-three varieties and experimental lines of fresh market cabbage were planted on May 11 and June 18, 1999 at the Vegetable Crops Research Branch in Fremont, OH. Three additional entries were planted on June 18, 1999 only. Plots of each entry were replicated five times per planting date and arranged in randomized complete block design, including planting date as a replication and design factor. Transplants were set into two-row spaced at 30 inches between rows and 10 inches between plants. Entries were harvested when mature. The total and individual weight of ten consecutive heads removed from each plot were recorded. The weight, size (polar and equatorial diameter), and core dimensions were recorded on five individual marketable-sized heads per plot. Subjective estimates of head density, internal color, and other traits were also made at harvest. Two heads per plot were sent to The OSU Food Industries Center for flavor and slaw cut quality evaluation. Results from these quality evaluations are presented in this report. All other data are summarized in Horticulture and Crop Science Series Report #695 (January 2000) which is available from Matt Kleinhenz (330-263-3810).

Project Goals

The primary goal of these studies was to develop information useful to Ohio growers in selecting varieties, especially for different planting periods. These studies were also designed to help explain how the interaction between genotype and growing environment impacts specific crop traits, including flavor and slaw cut quality.

To accomplish these goals, we planted a wide assortment of fresh market cabbage varieties and experimental lines in fully replicated plots in May and June. Yield and physical external and internal head traits were recorded. Samples were also submitted to The OSU Food Industries Center for flavor and slaw cut quality evaluation.

Materials and Methods

Transplant Production. Entries were solicited from cooperating seed companies in winter 1998-99 (Table 1). Transplants were seeded in early spring, allowed to develop 2-4 true leaves in the greenhouse, and hardened-off before planting into the field.

Plot Establishment. A randomized complete block design was used. The experiment contained five replications per entry per planting, two planting dates (May 11, June 18), twenty-three entries planted in May, and twenty-six entries planted in June. The two-row plots were established with a cone-type two-row transplanter. Each row was 15 ft. long (each row containing approx. 17 plants), with 30 in. between rows and 10 in. between transplants. A 0-46-0 fertilizer was used to supply 60 lb. P_2O_5 and a 0-0-60 fertilizer was used to supply 250 lb. K_2O in September 1998. Ammonium nitrate was broadcast to supply 70 lb N/A on May 1, 1999. A nutrient starter solution (0.7 qt. 10-34-0/50 gal. water) was delivered next to the transplants.

Plot Maintenance. Dead transplants were replaced (if possible) within one week of initial planting. Standard pest management strategies based on scouting, thresholds, and application of labeled pesticides were employed. Irrigation was applied on July 1 (0.10 in.) and July 16 (0.5 in.).

Data Collection (Field). Plots were reviewed two-three times weekly to assess development. Notes on plant stature, head shape, and other traits were taken on mature entries immediately prior to harvest.

Data Collection (at Harvest). Harvest readiness for individual entries was estimated from published maturity information and visual examination of the five plots per entry. At maturity, ten consecutive heads were removed from one row in each plot. These heads were weighed individually. Five marketable heads were then selected at random from the ten-head group for further evaluation. All but two wrapper leaves were removed. Thereafter, the polar and equatorial diameter of each whole head were recorded. Heads were then cut in half longitudinally and the core length and base width recorded. All data referred to in this section are summarized in Horticulture and Crop Science Series Report #695 (January 2000) which is available from Matt Kleinhenz (330-263-3810).

Flavor and Slaw Cut Quality Evaluation at The OSU Food Industries Center. Two heads remaining from the ten-head group collected at harvest from each plot were sent to The OSU Food Industries Center for further evaluation. Samples were identified with numbers only -- the Food Industries Center had no knowledge of the entries under evaluation. After arriving at the Food Industries Center, heads were stored in a walk-in cooler for several days until being evaluated. Heads were trimmed and cut and the flavor and slaw cut quality evaluated. Flavor was assessed by the Director and staff of the OSU Food Industries Center. Slaw was prepared by chopping several heads on a cutting board. The quality of the cut pieces was then recorded. Ratings of flavor and slaw cut quality were derived by Dr. Kleinhenz from written comments made at evaluation by the Director and staff of the Food Industries Center. Based on these written comments, Dr. Kleinhenz rated the flavor and slaw cut quality of each sample as undesirable (-), neutral (0), or desirable (+).

Results

Results are shown in Tables 3-5. Table 3 contains summary ratings (-, 0, +) for flavor and slaw cut quality, derived from written comments at evaluation by the Food Industries Center (shown in Tables 4 and 5).

Flavor, and to a lesser extent, slaw cut quality, appeared to be more effected by genotype than planting date. For example, within the May planting, 17%, 22%, and 61% of the genotypes were rated as having undesirable, neutral, and desirable flavor, respectively (Table 3). The percentages of genotypes in each flavor category were similar in the June planting (Table 3). The percentage of entries rated as having undesirable, neutral, or desirable slaw cut quality were more similar within and between planting dates (Table 3). For example, 28% and 50% of the genotypes were rated as having undesirable and desirable slaw cut quality in the May planting, respectively. The percentages in each slaw cut quality category were similar in the June planting also (Table 3). Although overall quality did not change significantly between planting dates, overall quality tended to be lower in the June compared to the May planting. The percentages of entries rated as having undesirable flavor or slaw cut quality were higher in the June than the May planting (Table 3).

Interpretation

Diverse markets, the need for sequential plantings, and the importance of quality in the marketplace complicate variety selection in fresh market cabbage. Genotype and management (e.g., planting date) affect

raw product quality, including flavor and slaw cut quality. Research-based information on how a variety responds to changes in planting date, for example, may assist growers in identifying varieties largely unaffected by planting date or in selecting varieties specifically for early or late planting.

The 1999 season was characterized for above average temperatures and below average rainfall (Table 2). Moisture deficits persisted throughout crop development in these studies. For example, rainfall was well below average for the period during which the June-planted fresh market type crop developed, especially in the first and last 25 days of the 100-day period described in Table 2.

In 1999, we initiated studies to identify and explain the contribution of genotype and planting date on fresh market cabbage flavor and slaw cut quality. Under these experimental conditions, genotype tended to have a stronger impact on flavor and slaw cut quality than planting date. Although quality tended to be higher in the May compared to the June planting, variation in quality appeared to be greater among genotypes than between planting dates. It is important to note that the quality of several genotypes differed between planting dates (Table 3).

For more information on this project or report, please contact Matt Kleinhenz (ph. 330-263-3810; E-mail kleinhenz.1@osu.edu).

Table 1. Fresh market cabbage genotypes planted at the Vegetable Crops Research Branch in Fremont, OH in 1999.

Entry	#	Company	Evaluated in 1998?	Date Planted	Harvest Date	# of Days to Harvest
AC780	1	Abbott & Cobb	no	11-May	30-Aug	112
				18-Jun	17-Oct	122
AC780	2	Abbott & Cobb	no	11-May	19-Aug	101
				18-Jun	29-Sep	104
Ac831	3	Abbott & Cobb	no	11-May	07-Sep	120
				18-Jun	19-Oct	124
Ac841	4	Abbott & Cobb	no	11-May	12-Aug	94
				18-Jun	19-Oct	124
Atlantis	5	Asgrow	no	11-May	19-Jul	70
				18-Jun	26-Aug	77
Blue Dynasty	6	Bejo	no	11-May	19-Aug	100
				18-Jun	07-Sep	82
Bobcat	8	Bejo	yes	11-May	26-Jul	77
				18-Jun	30-Aug	74
Bronco	9	Petoseed	yes	11-May	05-Aug	84
				18-Jun	07-Oct	112
Cheers	10	Harris Moran	no	11-May	29-Jul	80
				18-Jun	29-Sep	104
Columbia	11	Reed's	no	11-May	19-Jul	70
				18-Jun	23-Aug	67
Discovery	12	Rispen's		11-May	15-Jul	66
				18-Jun	23-Aug	67
DPSX 315	13	Petoseed	yes	11-May	19-Aug	101
				18-Jun	29-Sep	104
Emblem	14	Harris Moran	no	11-May	29-Jul	80
				18-Jun	07-Sep	82
Fresco	15	Asgrow	yes	11-May	26-Jul	77
				18-Jun	07-Sep	82
Gideon	16	Harris Moran	yes	11-May	26-Aug	108
				18-Jun	07-Oct	112
Red Dynasty	19	Am. Takii		11-May	16-Aug	98
				18-Jun	07-Oct	112
Rocket	20	Asgrow	yes	11-May	15-Jul	66
				18-Jun	23-Aug	67
Silver Dynasty	21	Reed's	yes	11-May	23-Aug	105
				18-Jun	19-Oct	124
Superelite	22	Bejo	yes	11-May	23-Aug	105
				18-Jun	19-Oct	124
Supreme Vantage	23	Rispen's		11-May	15-Jul	66
				18-Jun	23-Aug	67
Sure Vantage	24	Rispen's		11-May	19-Aug	101
				18-Jun	07-Oct	112
Vantage Point	25	Rispen's		11-May	26-Aug	108
				18-Jun	29-Sep	104
Morris	27	Bejo		11-May	15-Jul	66
				18-Jun	26-Aug	70
Blue Gem	28	Petoseed	yes	18-Jun	07-Sep	82
Gourmet	29	d. Palmer	no	18-Jun	07-Sep	82
Little Rock	30	Sakata	yes	18-Jun	07-Oct	112

Table 2. Climatic data for fresh market cabbage experiments planted at the Vegetable Crops Branch in Fremont, OH in 1999 on May 11 (Planting 1) and June 18 (Planting 2).

	Average Temp. (F)		------ Precipitation (in.) -------		
	High	Low	Actual	Normal	deficit
Planting 1					
May 11 - June 5 (25 d)	74.5	49.2	2.66	3.4	- 0.74
June 6 - July 26 (50 d)	85.9	58.9	4.71	6.5	- 1.79
July 27 - Aug. 21 (25 d)	83.0	56.7	1.92	3.0	- 1.08
Total			9.29	12.9	- 3.61
Planting 2					
June 18 - July 13 (25 d)	84.1	57.9	0.83	3.3	- 2.47
July 14 - Sept. 2 (50 d)	83.5	57.1	4.82	5.6	- 0.78
Sept. 3 - Sept. 28 (25 d)	79.7	46.3	0.31	2.7	- 2.39
Total			5.96	11.6	- 5.64

Irrigation was supplied on July 1 (0.10 in.) and July 16 (0.50 in.).

Table 3. Summary of head physical and sensory evaluation for twenty-one genotypes of fresh market cabbage planted on May 11 and June 18, 1999 at The OSU Vegetable Crops Research Branch in Fremont, OH. The flavor and slaw cut quality of mature heads were rated by Dr. Kleinhenz as undesirable (-), neutral (0), or desirable (+) based on notes taken during evaluation by The OSU Food Industries Center. Blank spaces indicate that the genotype was not evaluated.

	------- flavor -------		-------- slaw cut -------	
Genotype	May 11	June 18	May 11	June 18
AC780		+		+
AC790	+	+	+	+
AC831		+		-
AC841	0	+	+	-
Atlantis	+	0	-	-
Blue Dynasty	-	-	0	+
Bobcat	+	+	0	-
Bronco	+	+	+	-
Cheers	+	0	-	+
Columbia	+		0	
DPSX315	-	-	+	0
Discovery	+		+	
Emblem	-	+	-	+
Fresco	+		-	
Gideon		-		0
Red Dynasty	+	+	0	+
Rocket	+		+	
Silver Dynasty	0		+	
Superelite	+		-	
Supreme Vantage	0		+	
Sure Vantage	0	+	+	0
number evaluated	18	14	18	14
number undesirable (-)	3	3	5	5
number neutral (0)	4	2	4	3
number desirable (+)	11	9	9	6

Table 4. Sensory evaluation for twenty-one genotypes of fresh market cabbage planted on May 11 and June 18, 1999 at The OSU Vegetable Crops Research Branch in Fremont, OH. The flavor of leaves taken from mature heads was assessed by staff of The OSU Food Industries Center. Based on the comments shown, the overall flavor of the genotype was rated as undesirable (-), neutral (0), or desirable (+). Blank spaces indicate that the genotype was not evaluated.

Planting Date and Genotype	Flavor Assessment
May 11, 1999	
AC790	very mild, no residual flavor (+)
AC841	strong cabbage flavor, not hot, slightly sweet (0)
Atlantis	bland, mild, no hotness or residual flavor (+)
Blue Dynasty	undesirable, old, musty (-)
Bobcat	bland, mild, no hotness or bitterness (+)
Bronco	typical cabbage flavor, no hot, bitter or residual flavor (+)
Cheers	typical, good cabbage flavor (+)
Columbia	mild, typical, slightly sweet (+)
DPSX315	strong cabbage flavor, slightly hot residual flavor (-)
Discovery	mild, good, slightly sweet (+)
Emblem	undesirable, old, musty (-)
Fresco	very mild, lacks typical cabbage flavor (+)
Red Dynasty	mild, typical, not hot or sweet (+)
Rocket	mild, sweet (+)
Silver Dynasty	typical, slightly hot (0)
Superelite	mild, lacks typical cabbage flavor, slightly sweet (+)
Supreme Vantage	typical, slightly hot, not sweet (0)
Sure Vantage	mild, slightly hot, slightly sweet (0)
June 18, 1999	
AC780	mild, sweet, good cabbage flavor (+)
AC790	mild, sweet, typical cabbage flavor (+)
AC831	mild, not hot (+)
AC841	mild, slightly sweet (+)
Atlantis	mild but unpleasant field taste (0)
Blue Dynasty	mild but distinctive off-flavor (-)
Bobcat	mild, slightly sweet (+)
Bronco	good, mild, sweet, cabbage flavor (+)
Cheers	slightly sweet but also hot (0)
DPSX315	strong, slightly hot cabbage flavor (-)
Emblem	mild, typical, no residual (+)
Gideon	typical, slightly hot and bitter (-)
Red Dynasty	mild, sweet, lacks typical cabbage flavor (+)
Sure Vantage	mild, slightly sweet, slightly hot (0)

Table 5. Physical evaluation for twenty-one genotypes of fresh market cabbage planted on May 11 and June 18, 1999 at The OSU Vegetable Crops Research Branch in Fremont, OH. The quality of a slaw cut derived from mature heads was assessed by staff of The OSU Food Industries Center. Based on the comments shown, the overall quality of the slaw cut was rated as undesirable (-), neutral (0), or desirable (+). Blank spaces indicate that the genotype was not evaluated.

Genotype	Planting Date and Slaw Cut Assessment	
	May 11	June 18
AC780		crisp (+)
AC790	good, straight texture (+)	crisp, good, clean (+)
AC831		tough, ragged (-)
AC841	good, crisp (+)	large leaves, soft, mushy (-)
Atlantis	rough, large leaves (-)	large, unattractive leaves (-)
Blue Dynasty	not crisp (0)	good, crisp (+)
Bobcat	not crisp or clean (0)	undesirable (-)
Bronco	crisp, fine (+)	large, undesirable leaves (-)
Cheers	mushy (-)	good, crisp (+)
Columbia	not crisp (0)	
DPSX315	crisp (+)	crisp, tough (0)
Discovery	good (+)	
Emblem	mushy (-)	good (+)
Fresco	soft, mushy (-)	
Gideon		crisp, clean, tough, large leaves (-)
Red Dynasty	crisp, large leaves (0)	crisp, clean (+)
Rocket	crisp (+)	
Silver Dynasty	good, crisp (+)	
Superelite	tough, chewy (-)	
Supreme Vantage	crisp, fine (+)	
Sure Vantage	crisp (+)	crisp, tough (0)
number evaluated	18	14
number undesirable (-)	5	6
number neutral (0)	4	2
number desirable (+)	9	6

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